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Procedia Engineering 176 (2017) 71 – 84

Procedia Engineering

www.elsevier.com/locate/procedia

Dynamics and Vibroacoustics of Machines (DVM2016)

Research of the influence of several constants of the quadratic turbulence model on the results of pulsated separated flow simulation

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Abstract

Offered in this article modification variant of quadratic High-Reynolds number k-ε turbulence model is intended for more accurate prediction of the local characteristics of pulsated separated turbulent flow of compressible gas in channel behind diaphragm at rather high values of Strouhal number. Correction functions C_1 and κ values are determined at Sh = 0..0.5, Re = 17000 and Re = 33000 regimes. Thus, the mathematical model of the flow is represented by the Reynolds-averaged Navier-Stokes equations, continuity equation, energy equation, equation of the ideal gas, equations of the original and modified turbulence model. The dimensions of the computational region, regime parameters and experimental data of the flow characteristics are taken from the dissertation of I.A. Davletshin. Generation of the pulsation in numerical experiments is achieved by periodic fluctuation of the outlet area in the channel during the time. Verifying calculations were carried out. Simulation results (skin-friction and pressure coefficients, reattachment length, turbulent characteristics) were compared with experimental data. Shear stress and axial velocity varying along the channel during the pulsation period was analyzed. It was established that original turbulence model permits necessary calculation accuracy only at Sh < 0.07, moreover, applying of the correction function allows to predict behavior of observed flow parameters at a higher pulsation frequency.

Peer-review under responsibility of the organizing committee of the international conference on Dynamics and Vibroacoustics of Machines

Keywords: pulsated flow; separated flow; turbulent flow; numerical simulation; turbulence model; reattachment length

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Peer-review under responsibility of the organizing committee of the international conference on Dynamics and Vibroacoustics of Machines
doi:10.1016/j.proeng.2017.02.275